

The opinion in support of the decision being entered today was **not** written for publication and is **not** binding precedent of the Board.

Paper No. 14

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JEFFREY R. HUFTON, SHIVAJI SIRCAR, WILLIAM F. BAADE,
JOSEPH M. ABRARDO and MADHU ANAND

Appeal No. 1998-1273
Application No. 08/624,148

ON BRIEF

Before WALTZ, LIEBERMAN, and PAWLIKOWSKI, Administrative
Patent Judges.

WALTZ, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1 through 19, which are the only claims pending in this application.

According to appellants, the invention is directed to a steam methane reforming (SMR) process for producing an essentially pure hydrogen product and an essentially pure carbon monoxide product wherein the SMR process is integrated with a reverse water gas shift reaction process which utilizes

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a series of adsorption and purge steps (Brief, pages 4-7). A copy of illustrative claim 1 is attached as an Appendix to this decision.

The examiner has relied upon the following references as evidence of obviousness:

Stönner et al. (Stönner)	4,491,573	Jan. 1, 1985
Keefer	5,256,172	Oct. 26, 1993
Dandekar et al. (Dandekar)	5,449,172	Sep. 12, 1995
(filed Aug. 1, 1994)		

Kikuchi et al. (Kikuchi), "Hydrogen Production from Methane Steam Reforming Assisted by use of Membrane Reactor," 509-515, *Natural Gas Conversion*, Elsevier Science Publishers B.V., Amsterdam, 1991.

Appellants have relied upon the following reference in rebuttal to the examiner's rejection under the second paragraph of 35 U.S.C. § 112:

Twigg, ed., *Catalyst Handbook*, 2nd ed., pp. 283-289, Wolfe Publishing Co. (1989).

The claims on appeal stand rejected under 35 U.S.C. § 112, ¶1, "as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed

invention." Answer, paragraph bridging pages 2-3. The claims on appeal also stand rejected under the second paragraph of section 112 "as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards [sic, appellants regard] as the invention." Answer, page 3. Claims 1-9, 11-17 and 19 stand rejected under 35 U.S.C. § 103 as unpatentable over Dandekar taken with Keefer and Stönnner (*id.*). Claims 10 and 18 stand rejected under 35 U.S.C. § 103 as unpatentable over Dandekar taken with Keefer and Stönnner further in view of Kikuchi (Answer, page 4). We reverse all of the examiner's rejections essentially for the reasons in the Brief and the reasons set forth below.

OPINION

A. The Rejection under 35 U.S.C. § 112, ¶2

The claimed subject matter should be analyzed for definiteness under the second paragraph of section 112 and then for compliance with the first paragraph before the scope of the claimed subject matter can be compared to the applied prior art references in a proper analysis under 35 U.S.C. § 103. See *In re Angstadt*, 537 F.2d 498, 501, 190 USPQ 214, 217

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(CCPA 1976), citing *In re Moore*, 439 F.2d 1232, 1235, 169 USPQ 236, 238 (CCPA 1971).

"The legal standard for definiteness [under section 112, ¶2] is whether a claim reasonably apprises those of skill in the art of its scope. [Citations omitted]." *In re Warmerdam*, 33 F.3d 1354, 1361, 31 USPQ2d 1754, 1759 (Fed. Cir. 1994).

"[T]he definiteness of the language employed must be analyzed - not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art." *Angstadt, supra; Moore, supra*.

The examiner has stated that the terms "high," "low" and "medium" in claims 11 and 19 on appeal are subjective and thus unclear, and the term "predetermined time sequence" in claim 1, part (c) and claim 12, part (e), is unclear in the basis for determining it (Answer, page 3).¹

Subjective terms such as "high," "low" and "medium" are not necessarily indefinite and unclear. When a word of degree

¹ The examiner's final rejection of the claimed word "isothermal" under section 112, ¶2, is withdrawn. See the Answer, page 6.

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is used, it must be determined whether the specification defines or limits this word and whether one of ordinary skill in the pertinent art would understand what is claimed when the claim is read in light of the specification. See *Andrew Corp. v. Gabriel Electronics*, 847 F.2d 819, 821-22, 6 USPQ2d 2010, 2012-13 (Fed. Cir. 1988); *Seattle Box Co., Inc. v. Industrial Crating & Packing, Inc.*, 731 F.2d 818, 826, 221 USPQ 568, 573-74 (Fed. Cir. 1984). Here we determine that appellants have submitted evidence that one of ordinary skill in the art would have understood the claimed words "high," "low" and "medium" in relation to high and low temperature water gas shift reaction catalysts. See attachment A to the Brief (Twigg). Although Twigg is not specific to copper/zinc oxide catalysts, it is our opinion that sufficient criteria are set forth in Twigg for one of ordinary skill in this art to understand what was meant by the claim language with respect to any specific water gas shift reaction catalyst.

The initial burden of presenting a *prima facie* case of unpatentability on any ground rests with the examiner. See *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed.

Cir. 1992). With respect to the phrase "predetermined time sequence," the examiner has not met this initial burden of establishing that one of ordinary skill in the art would not be apprised of the scope of the claim, keeping in mind that the claim must be read in light of the specification. See the specification, page 20, where the predetermined time sequences are exemplified, and page 26, where the sequence periods are explained.

For the foregoing reasons, we determine that the examiner has not established that the claimed language is indefinite and unclear to one of ordinary skill in the art when read in light of the specification. Accordingly, the examiner's rejection of the claims on appeal under 35 U.S.C. § 112, ¶2, is reversed.

B. The Rejection under 35 U.S.C. § 112, ¶1

The examiner finds that there is no support for the specific negative limitation "wherein the weakly adsorbing purge fluid is a fluid other than a CO-enriched fluid" in part (c), step (3), of claim 1 on appeal (Answer, page 3).

Appellants submit that there is implicit basis or support for

this phrase when steps (3) and (4) are read together (Brief, pages 9 and 11).

An *ipsis verbis* disclosure is not necessary to satisfy the written description requirement of section 112. The disclosure need only reasonably convey to one of ordinary skill in the art that the inventors had possession of the subject matter in question. See *In re Edwards*, 568 F.2d 1349, 1351-52, 196 USPQ 465, 467 (CCPA 1978). We agree with appellants that steps (3) and (4) of claim 1, part (c), when read together, reasonably convey to one of ordinary skill in the art that appellants had possession of the phrase in question since step (4) must be a countercurrent purge with "a CO-enriched fluid" sufficient to desorb the weakly adsorbing purge fluid of step (3). See the specification, page 40, lines 1-7. The "weakly adsorbing fluid" in step (3) must be capable of being desorbed by the CO-enriched purge fluid of step (4).

For the foregoing reasons, we determine that appellants have provided implicit support that would reasonably convey to one of ordinary skill in the art that appellants were in

possession of the subject matter in question in claim 1, part (c), step (3). Accordingly, the examiner's rejection of claims 1 through 19 under 35 U.S.C. § 112, ¶1, is reversed.

C. The Rejections under 35 U.S.C. § 103

The examiner finds that "Dandekar teaches in col. 2 line 60-col. 3 line 68, col. 6 lines 25-40, col. 8 lines 20-45 and col. 10 lines 20-65 reacting steam and methane at 270EC and 5 atm pressure, removing water, pressurizing (which increases the temperature; $PV=nRT$) and ultimately passing the effluent gas stream through a PSA process." Answer, page 3. The examiner further finds that "Dandekar differs in not teaching the reforming temperature, the amount of catalyst or the PSA separation." *Id.* Therefore the examiner applies Keefer to show the PSA separation and Stönnner to show the reforming temperature. Answer, page 4.

As noted above, it is well settled that the examiner bears the initial burden of presenting a *prima facie* case of unpatentability. See *Oetiker, supra*. Here the examiner has not presented any convincing evidence or reasoning that the separation steps of Keefer are operated isothermally as

required by claim 1, part (c). The examiner has cited Dandekar as suggesting temperature control or isothermal beds (Answer, page 3, citing col. 7, ll. 35-45). However, this disclosure in Dandekar relates only to attempts to "minimize the temperature increase" in the reactor beds and does not disclose or suggest isothermal operation (see col. 7, ll. 37-38).

The examiner cites col. 13, l. 30-col. 14, l. 40 of Keefer (Figure 8) to show the embodiment of Keefer directed to the water gas shift reaction (Answer, page 4). However, claim 1, part (c), step (1) calls for reaction conditions sufficient to convert carbon dioxide and hydrogen to carbon monoxide and water, i.e., the reverse water gas shift (see the specification, page 1, ll. 11-16, and page 8, ll. 1-10). The examiner has not explained why one of ordinary skill in the art would have modified the reaction conditions of Keefer to attain the reaction conditions required by claim 1 on appeal. The examiner has also not explained by convincing evidence or reasoning why the prior art discloses or suggests the "predetermined time sequences" as required by claim 1 on appeal. Furthermore, the examiner has merely stated that

"Keefer teaches the claimed countercurrent gas flow and adsorbent" and teaches a purge gas with recycling (Answer, page 4). However, the examiner has not particularly pointed out where the claimed order of countercurrent depressurizing and pressurizing steps with countercurrent purging steps was disclosed or suggested by Keefer (i.e., the steps of claim 1, part (c), steps (2) through (5)).

The examiner has also not presented any convincing evidence or reasoning for the motivation set forth justifying the proposed combination of Dandekar and Keefer, i.e., "because doing so recovers the non-reacted gases and makes the process more economically efficient." Answer, page 4. The motivation to combine references may come from the references themselves, the knowledge of those skilled in the art, or the nature of the problem to be solved. See *Micro Chemical Inc. v. Great Plains Chemical Co.*, 103 F.3d 1538, 1546, 41 USPQ2d 1238, 1244-45 (Fed. Cir. 1997). Here the examiner has not identified where the suggestion to combine the references as proposed can be found, why one of ordinary skill in the art would have been motivated to recover non-reacted gases, and

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why adding more process steps would have been more
"economically efficient."

The examiner has applied Stönner and Kikuchi to show the reforming temperature and a noble metal steam reforming catalyst, respectively (Answer, page 4). Accordingly, these references do not remedy the deficiencies discussed above with regard to Dandekar and Keefer.

For the foregoing reasons and those set forth in the Brief, we determine that the examiner has not presented a *prima facie* case of obviousness in view of the reference evidence. Therefore the rejections of claims 1-9, 11-17 and 19 under section 103 over Dandekar taken with Keefer and Stönner and claims 10 and 18 under section 103 over these references further in view of Kikuchi are reversed.

D. Summary

The rejection of claims 1-19 under 35 U.S.C. § 112, ¶2, is reversed. The rejection of claims 1-19 under 35 U.S.C. § 112, ¶1, is reversed. The rejection of claims 1-9, 11-17 and 19 under 35 U.S.C. § 103 as unpatentable over Dandekar taken with Keefer and Stönner is reversed. The rejection of claims

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10 and 18 under 35 U.S.C. § 103 over Dandekar taken with
Keefer and Stönnner further in view of Kikuchi is reversed.

The decision of the examiner is reversed.

REVERSED

THOMAS A. WALTZ)	
Administrative Patent Judge)	
)	
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)	BOARD OF PATENT
PAUL LIEBERMAN)	APPEALS
Administrative Patent Judge)	AND
)	INTERFERENCES
)	
)	
)	
BEVERLY A. PAWLIKOWSKI)	
Administrative Patent Judge)	

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APPENDIX

1. A process for producing carbon monoxide which comprises the steps of:

- (a) reacting a feed stock comprising methane and water in the presence of a steam methane reforming catalyst at a temperature ranging from 700°C to 1000°C and a pressure ranging from 2 to 50 atmospheres to form a reformat comprising hydrogen, carbon monoxide, carbon dioxide and unreacted feedstock;
- (b) removing water from the reformat to form a water-depleted reformat and heating the water-depleted reformat to a temperature ranging from 200° to 500°C to form a heated water-depleted reformat;
- (c) introducing the heated water-depleted reformat into a plurality of reactors operated isothermally in a predetermined timed sequence and according to the following steps which are performed in a cycle within each reactor:
 - (1) reacting the heated water-depleted reformat at a first pressure in a first reactor containing an admixture of a water adsorbent and a water gas shift catalyst under reaction conditions sufficient to convert carbon dioxide and hydrogen to carbon monoxide and to adsorb water onto the adsorbent and withdrawing a CO-enriched stream under a relatively constant flow rate at the first pressure;
 - (2) countercurrently depressurizing the first reactor to a second pressure by withdrawing a mixture comprising unreacted feedstock, carbon monoxide and water;
 - (3) countercurrently purging the first reactor at the second pressure with a weakly adsorbing

purge fluid with respect to the adsorbent wherein the weakly adsorbing purge fluid is a fluid other than a CO-enriched fluid to desorb water from the adsorbent and withdrawing a mixture comprising unreacted feedstock, carbon monoxide and water;

- (4) countercurrently purging the first reactor at the second pressure with a CO-enriched purge fluid which does not comprise hydrogen and carbon dioxide to desorb the weakly adsorbing purge fluid and withdrawing a mixture comprising the weakly adsorbing purge fluid, carbon monoxide and water; and
- (5) countercurrently pressurizing the first reactor from the second pressure to the first pressure with the CO-enriched purge fluid prior to commencing another process cycle within the first reactor.